MDR220A-R2 Wireless 900 MHz Modem

User's Manual
Version 1.0

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Document Information

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If, after inspection, Black Box determines that there is a defect, Black Box will repair or replace the OEM transceiver at their discretion. If the product is replaced, it may be a new or refurbished product.

Revision History

Revision	Description
Version 1.0	1/3/08 - Initial Release Version

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MDR220A-R2 RF TRANSCEIVER

1

Black Box's new MDR220A-R2 RF transceiver is a Frequency-Hopping Spread Spectrum (FHSS) radio designed for license free operation in the 900 MHz ISM band. Requiring no additional FCC licensing in the Americas, OEMs can easily make existing systems wireless with little or no RF expertise. The MDR220A-R2 and MDR221A-R2 products provide a wireless point-to-point connection between an RS232 device and a 56k data/fax modem.

OVERVIEW

This document contains information about the hardware and software interface between a MDR220A-R2 transceiver and an OEM Host. Information includes the theory of operation, specifications, interface definitions, configuration information and mechanical drawings.

Note: Unless mentioned specifically by name, the MDR220A-R2 will be referred to as "radio" or "transceiver". Individual naming is used to differentiate product specific features. The host (PC/Microcontroller/Any device to which the MDR220A-R2 is connected) will be referred to as "OEM Host" or "Host."

SPECIFICATIONS

Table 1: ConnexNet Specifications

General	
Interface Connector	Dual RJ-11 jack
RF Connector	RPSMA (Reverse polarity SMA) jack
Impedance	50 ohms unbalanced
Channels	32 (USA/Canada), 7 (Australia)
Security	One byte System ID. 56-bit DES encryption key.
Interface Buffer Size	Input/Output: 256 bytes
Transceiver	
Frequency Band	902 - 928 MHz (USA/Canada); 915 - 928 MHz (Australia)
RF Data Rate (Raw)	76.8 kbps
RF Technology	Frequency Hopping Spread Spectrum (FHSS)
Output Power EIRP (3dBi gain antenna)	1000 mW
Supply Voltage	7 - 25 VDC
Current Draw (mA)	TBD
Sensitivity	-99dBm
Range, Line of Site (based on 3dBi gain antenna)	Up to 20 miles
Environmental	
Temperature (Operating)	-40°C to 85°C
Physical	
Dimensions	4.4” x 2.7” x 1.4”
Certifications	
FCC Part 15.247	KQLAC4490
Industry Canada (IC)	2268C-AC44901000

3

HARDWARE INTERFACE

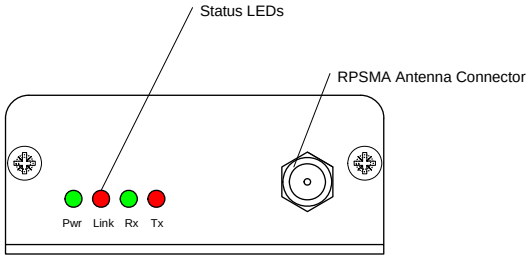


Table 2: Status LED descriptions

LED	Color	Description
Power	Green	On indicates that the unit is powered up.
Link	Red	On indicates that the Client unit(s) and Server unit are in Range of each other. Client unit activates the Link LED when in range of the Server unit. Always lit on a Server unit.
RXD	Green	When flashing, indicates that the device is receiving data.
TXD	Red	When flashing, indicates that the device is transmitting data.

CONFIGURATION UTILITY

4

OVERVIEW

Black Box provides an easy to use Configuration utility to program and test the device. The GUI based software is compatible with Microsoft® Windows 95, 98, 2000, ME, NT, & XP.

SOFTWARE INSTALLATION

Locate the OEM software folder on the Black Box Tools & Literature CD and install the development kit software. To install the software, run Setup.exe and follow the installation prompts. During the installation, the software will prompt the user to install the Black Box USB Driver. It is recommended that the user installs the driver at the same time as the software.

Note: The USB driver is only required for Black Box devices with a USB interface and is not required by the MDR220A-R2 transceiver.

The installer will notify the user when the software has successfully been installed. The user may be prompted to reboot the PC to complete the installation.

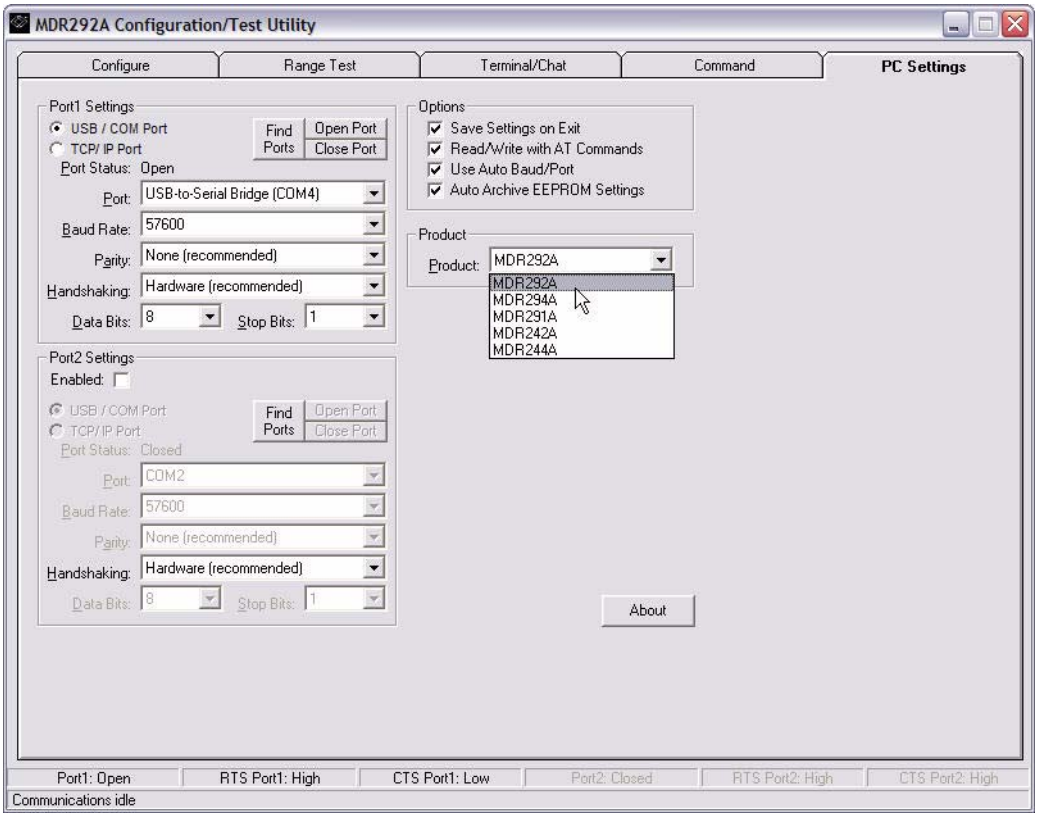
Click **OK** to complete the installation. By default, the software is stored in the following location on the Start Menu:

Start -> All Programs -> Black Box Network Services -> Black Box Config

PC SETTINGS PAGE

The PC Settings page is shown below, as it will appear the first time the program is run.

The first time the software is run, it will prompt you to select a product. Select the correct product in the Product pull-down menu. Doing this will automatically select the default baud rate for that particular transceiver. If the COM port is listed as unavailable, a different COM port can be selected in the Port pull-down menu. The software can use two serial ports if the Enabled: box is checked.



Port1/Port2 Options

The software can control up to (2) COM ports or TCP/IP ports, including virtual COM ports, which physically map to USB or Ethernet ports. An error message will be displayed if a port is selected that is either nonexistent or already occupied by another software program. When a port selection is made, the software will attempt to open the port and list its status as; Unavailable, Open or Closed. Although menus are shown for Data Bits, Parity and Stop Bits, only the Parity menu selection can be changed.

USB/COM PORT

Select this if you are using a standard COM port or have setup the ConnexNet as a Virtual COM Port.

TCP/IP PORT

Select this is you are connecting to the ConnexNet using a TCP/IP socket (default configuration).

Note: The port field must be set to 2101.

FIND PORTS BUTTON

If the available COM ports / IP addresses are unknown, the Find Ports button can be pressed to update the Port Selection pull-down menu with all available COM ports / IP addresses.

HANDSHAKING

By default the OEM utility will use hardware handshaking and monitor the CTS/RTS lines. For cases where these lines are not readily available such as RS-485 communications, the handshaking can be disabled by selecting “None” from the dropdown box.

Note: Handshaking box does not appear when TCP/IP Port is selected.

Other Options

These are additional options that can be enabled.

SAVE SETTINGS ON EXIT

When enabled, all changes made to the Settings page will be automatically loaded the next time the software is run. Otherwise, the changes will be discarded.

READ/WRITE WITH AT COMMANDS

When enabled, the software will use AT Commands for its read/write EEPROM functions instead of the standard configuration commands. This box should be enabled at all times.

AUTO BAUD

When enabled, the software will scan all available COM Ports using the most common baud rates, until a radio is found. If no radio is found or the software cannot open the port, an error message will be reported. The software will only use Auto Baud when prompted by the user after an unsuccessful write process. To cancel the Auto Baud process, press the ESC key.

Note: Auto Baud feature does not work when TCP/IP Port is selected.

AUTO ARCHIVE EEPROM SETTINGS

When enabled, the software will archive the EEPROM settings for each radio after a successful write process. Although not required, the software will prompt the user to type a description of the changes made. Auto Archive can be used to restore the radio to a previously known working configuration. The first time that a radio is read with Auto Archive enabled will be stored as the “Original Configuration Settings” with the date and time the record was created.

MONITOR UDP FOR NEW DEVICES

When enabled, the software will automatically listen for new ConnexNet devices using the UDP port and automatically add them to the Port Selection dropdown.

Status Bar

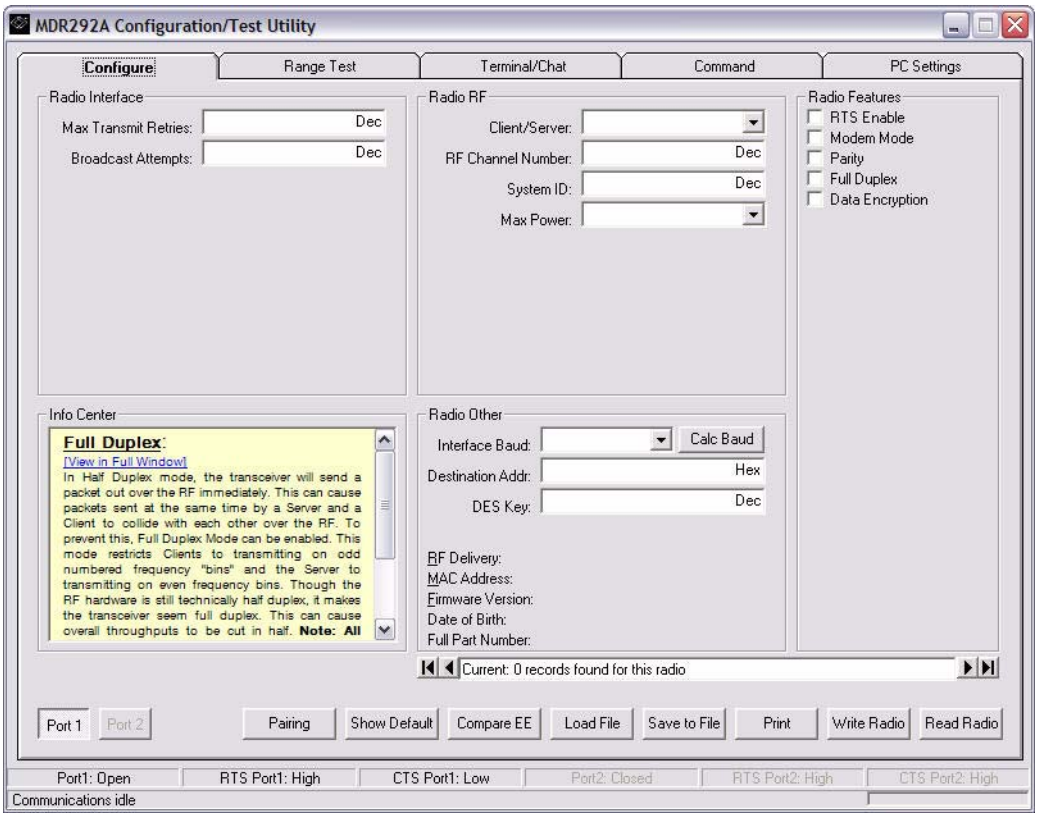
Located at the bottom of the software, the status bar gives the state of Port 1, RTS Port 1, CTS Port 1, Port 2, RTS Port 2, and CTS Port 2 lines. When the text appears black, the current state will be shown. When the text appears gray, the current state will not be shown. The text shown in the bottom status bar gives a simplified status of the current, pending software process. The software has no pending process when "Communications Idle" is shown.

About Button

The About button can be pressed to determine the revision number of the software and the contact information for Black Box. Please include the software revision number in any correspondence with Technical Support.

CONFIGURE PAGE

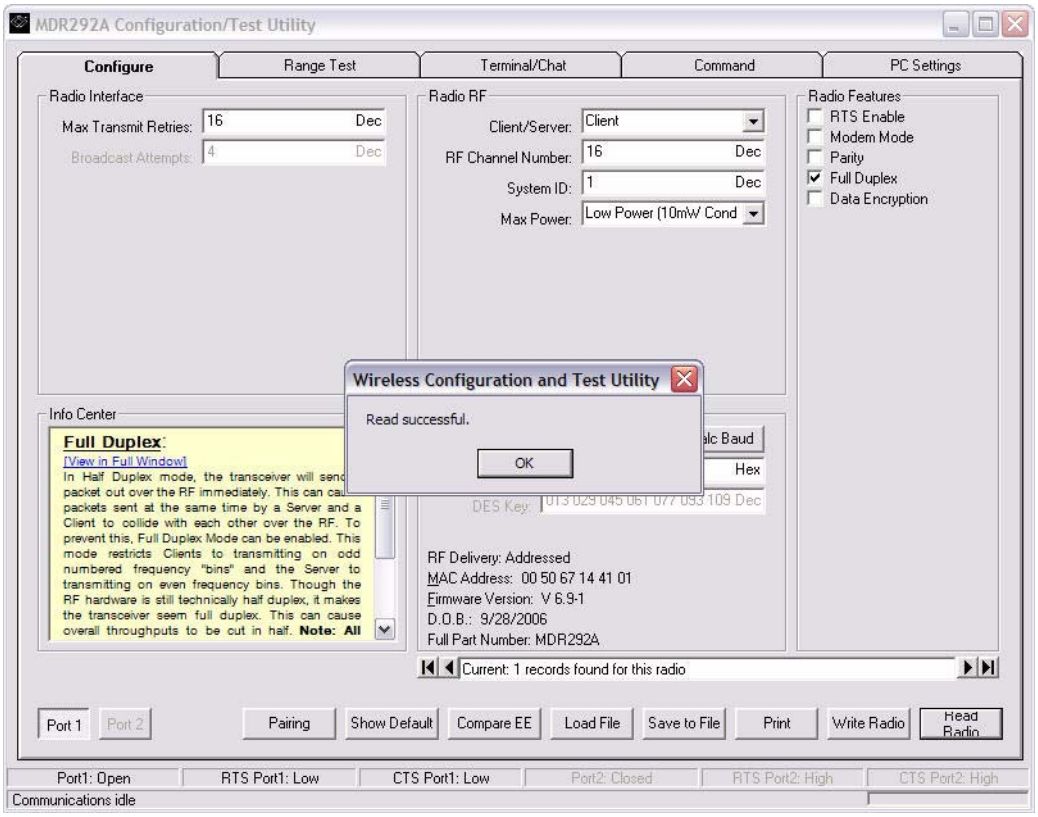
The Configure page is a GUI representation of the 256 byte EEPROM contents within the radio. The same data is shown in a full hexadecimal dump of the EEPROM in the EEPROM Editor View. The Configure page is shown below, as it will appear until a radio is successfully read:



There are five sections on the Configure page; Radio Interface, Radio RF, Radio Features, Radio Other, and Info Center. The fields displayed in these sections vary depending on the Product Mode. The Info Center provides a quick description of each setting/mode. For detailed decriptions of the individual settings, please refer to the OEM Module user's manual.

Read Radio Button

To update the Configure and EEPROM Editor View pages with the EEPROM contents of a radio you are currently connected to, click the Read Radio button. An example of the Configure page after a transceiver has successfully been read is shown below:


MDR292A Configuration/Test Utility
Configure
Range Test
Terminal/Chat
Command
PC Settings
Radio Interface
Max Transmit Retries: 16 Dec
Broadcast Attempts: 4 Dec
Radio RF
Client/Server: Client
RF Channel Number: 16 Dec
System ID: 1 Dec
Max Power: Low Power (10mW Cond
Radio Features
RTS Enable
Modem Mode
Parity
Full Duplex
Data Encryption
Wireless Configuration and Test Utility
Read successful.
OK
Info Center
Full Duplex:
[View in Full Window]
In Half Duplex mode, the transceiver will send packet out over the RF immediately. This can cau packets sent at the same time by a Server and a Client to collide with each other over the RF. To prevent this, Full Duplex Mode can be enabled. This mode restricts Clients to transmitting on odd numbered frequency "bins" and the Server to transmitting on even frequency bins. Though the RF hardware is still technically half duplex, it makes the transceiver seem full duplex. This can cause overall throughputs to be cut in half. Note: All
Hex
DES Key: 013 029 045 061 077 093 109 Dec
RF Delivery: Addressed
MAC Address: 00 50 67 14 41 01
Firmware Version: V 6.9-1
D.O.B.: 9/28/2006
Full Part Number: MDR292A
Current: 1 records found for this radio
Port 1
Port 2
Pairing
Show Default
Compare EE
Load File
Save to File
Print
Write Radio
Read Radio
Port1: Open
RTS Port1: Low
CTS Port1: Low
Port2: Closed
RTS Port2: High
CTS Port2: High
Communications idle

Write Radio Button

After making changes to the controls on the Configure page, the Write Radio button can be pressed to save those changes to the radio EEPROM. The user will be notified of a successful write with a "Write successful" prompt. If Auto Archive is enabled, the software will prompt the user to type a description of the changes made.

Show Defaults Button

When the Show Defualts button is pressed, the GUI view will be updated with the default settings for the selected product. This feature is only available on the GUI Page and will not work when using the EEPROM Editor View.

Pairing Button

The pairing button can be used to pair (address) two radios together. The two radios must both be connected to the PC and to the Ports specified on the PC Settings page. The pairing function sets one radio as a Server and the other as a Client and programs each radio's Destination Address with the other radio's MAC Address.

Load / Save to File Buttons

A file previously created by this software can be loaded to restore an EEPROM to a former state. Files of type *.TXT and *.EE can be loaded.

An EEPROM can be saved to a file using the Save to File button. This allows for the current state of the EEPROM to be restored at a later time.

Port 1/Port 2 Buttons

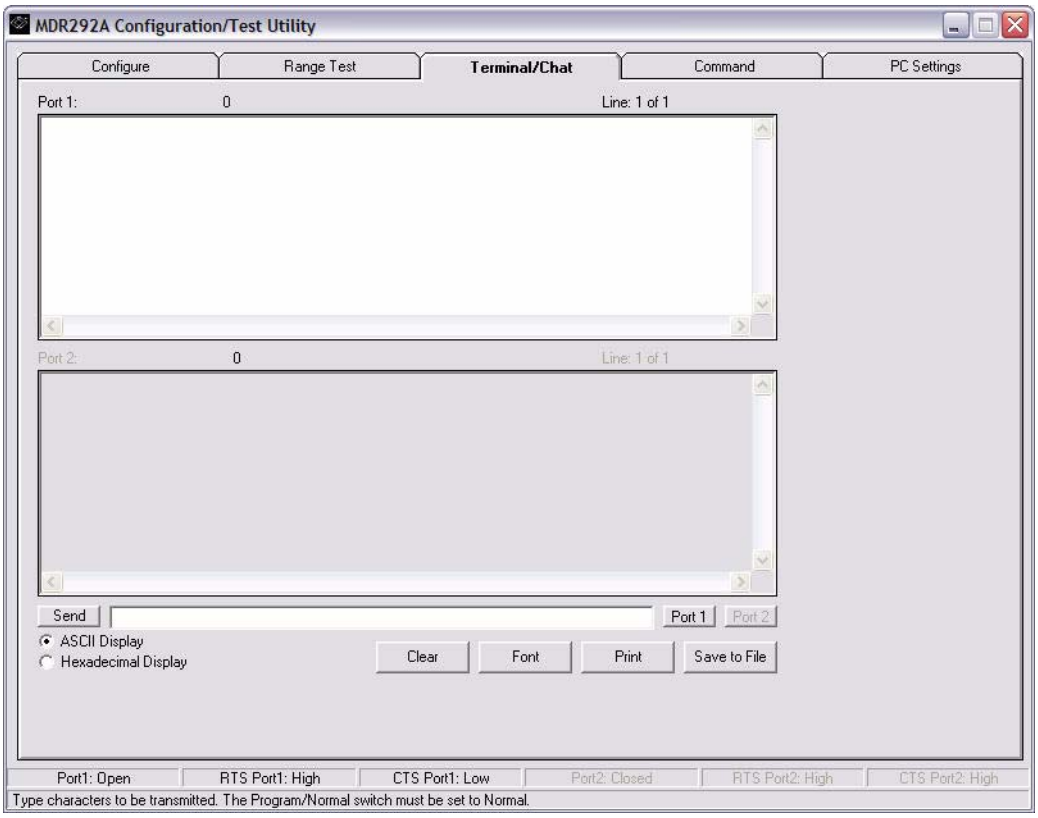
When Port 1 is depressed, the Write Radio and Read Radio buttons communicate through Port 1. When Port 2 is depressed, the Write Radio and Read Radio buttons communicate through Port 2.

Hex/Decimal Button

All of the text entry type boxes found on the Configure page have a button located to the right of the box. When pressed a menu will be shown which allows the selection of either Hexadecimal or Decimal numbering format for that particular text box.

TERMINAL/CHAT PAGE

The Terminal/Chat page is a terminal emulator (similar to HyperTerminal) used to send small data packets between two COM ports. As data is received it is appended to the appropriate Port window. An example of the Terminal/Chat page is shown below.



Send Button

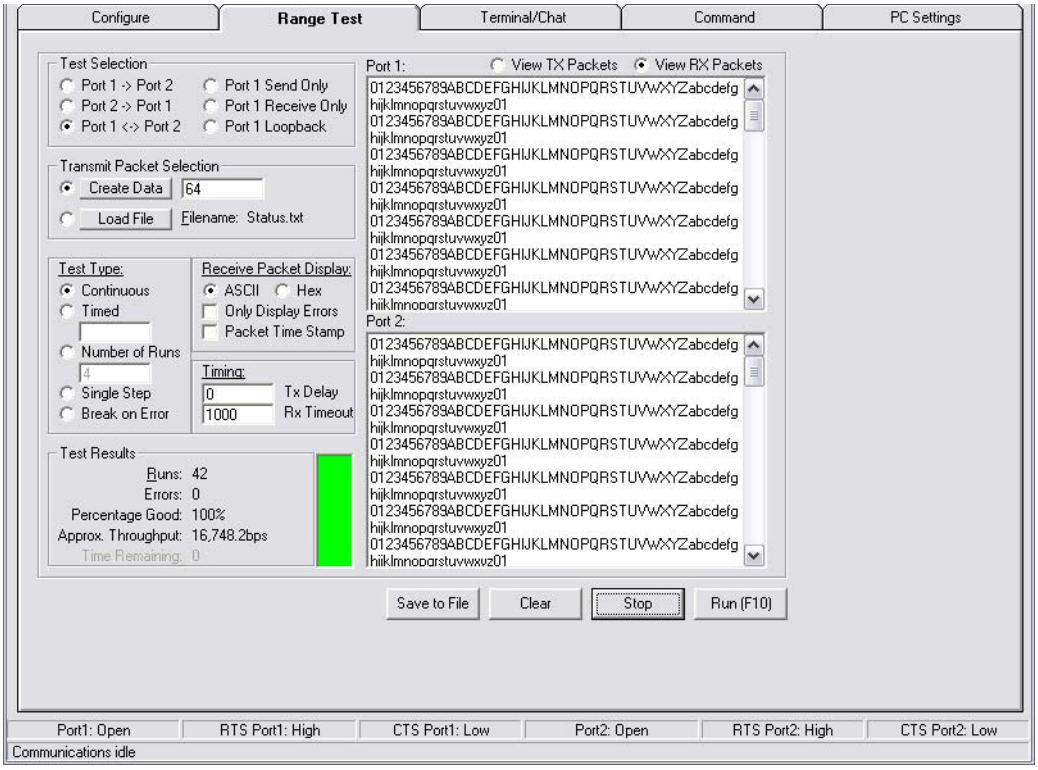
This button sends the data in the textbox out the selected port(s). The current user's Windows username is also sent over the RF with the data.

Hexadecimal / ASCII Display

New received data will be displayed in ASCII or Hexadecimal format; depending on the current setting.

RANGE TEST PAGE

The **Range Test** page allows packets of data to be sent between two radios and reports the numbers of successes and errors.



Test Selection

There are six test options that can be selected. There are three typical hardware setups.

1. One radio is plugged into a serial or USB port on a PC. The second radio is plugged into a separate power supply with a loopback adapter connected.
2. One radio is plugged into a serial or USB port on a PC. The other radio is plugged into a different serial or USB port on the same computer.
3. One radio is plugged into a serial or USB port on a PC. The other radio is connected to a serial or USB port on another PC.

If using two PCs for the test, the software run on both sides should have the second COM port disabled on the Settings page.

Table 3: Test Selection Settings

Test Selection	Port 1 Action	Port 2 Action	Hardware Setup
Port 1 -> Port 2	TX	RX	2
Port 2 -> Port 1	RX	TX	2
Port 1 <-> Port 2	TX/RX	TX/RX	2
Port 1 Send Only	TX	N/A	3
Port 1 Receive Only	RX	N/A	3
Port 1 Loopback	TX/RX	N/A	1

Transmit Packet Selection

This section allows you to select the data packet used to perform the Range Test. You may either create data of a specified byte length or load your own text or configuration file.

Test Type

The test type allows you to select how long the test will be performed.

Table 4: Test Type

Test Type	Description
Continuous	Test will run until stopped.
Timed	Test will run for a specified time period
Number of Runs	Test will run for a specified number of runs
Single Step	Test will run for a single step.
Break on Error	Test will run until an error occurs

Receive Packet Display

This section allows you to select how the received packets will be displayed. Received packets can either be displayed in ASCII or Hexadecimal format, marked with a time stamp, and show only when an error has occurred.

DEVICE SETUP

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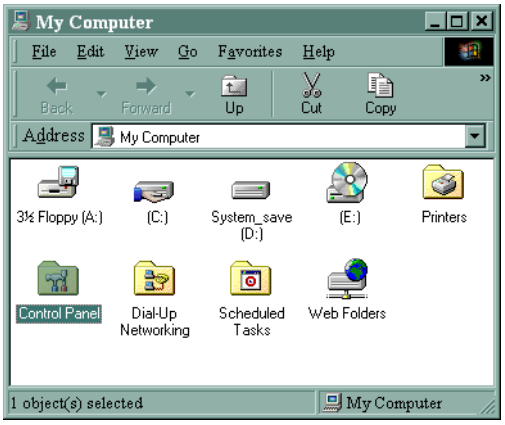
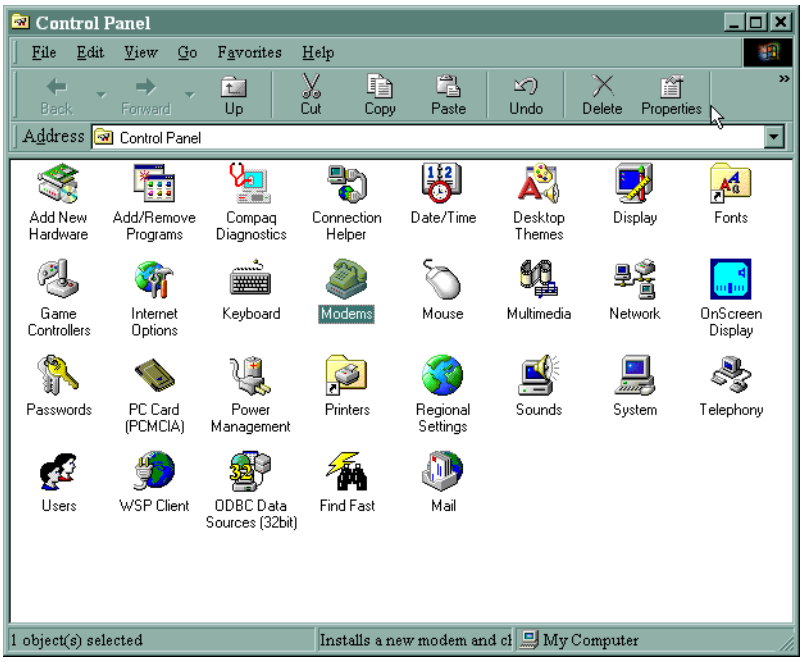
WINDOWS MODEM SETUP & CONFIGURATION

When connecting the MDR220A-R2 to a computer running Windows 95, 98, Me, 2000, or NT, the correct modem driver must be installed and properly configured. Please follow the steps and diagrams below to complete the setup and configuration.

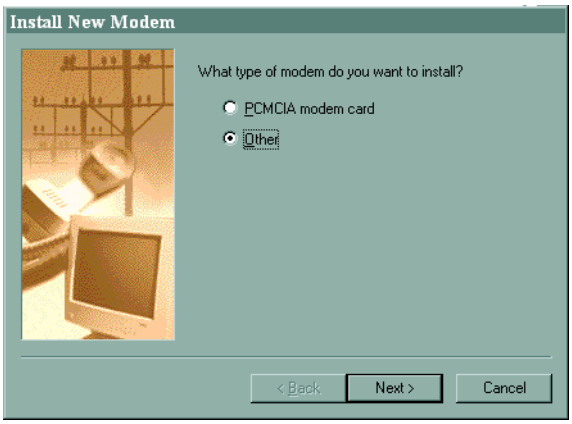
1 Double-click on **My Computer** on the desktop, double-click on **Control Panel**, double-click **Modems** to display the **Modems Properties** window.



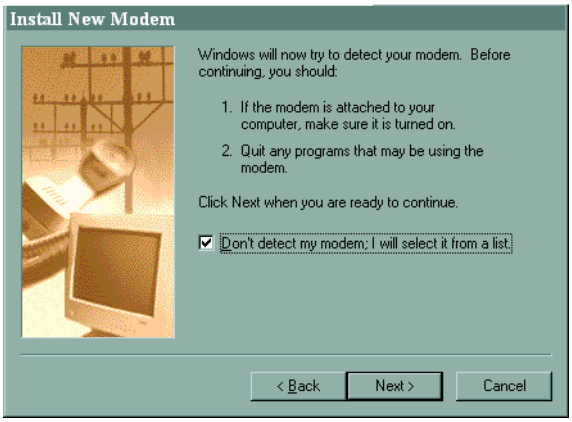


2 If the **Standard 56000 bps K56Flex Modem** is not installed, click **Add...** to install a new modem.

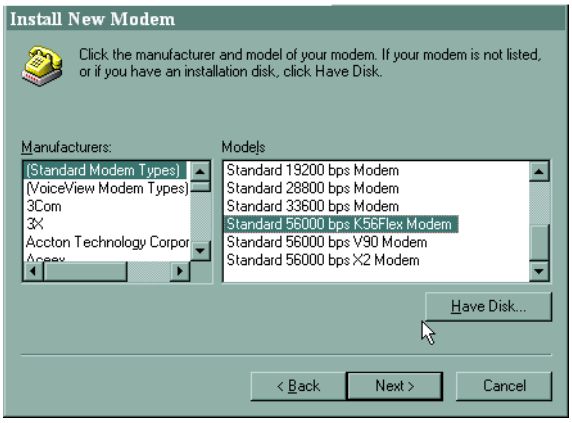
3 Select **Other** when asked what type of modem you want to install, then click on **Next>**.



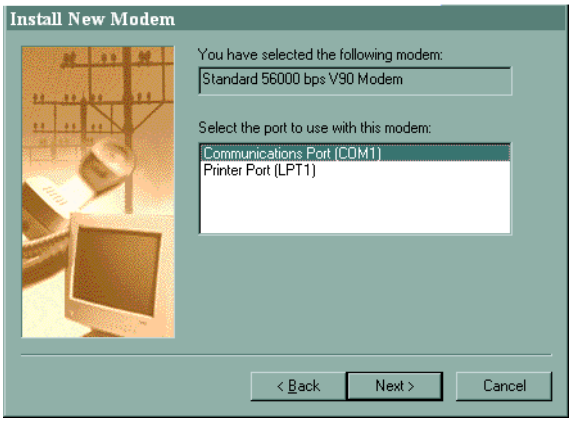
4 Select **"Don't detect my modem; I will select it from a list"**. Then select **Next>**.


Install New Modem
Windows will now try to detect your modem. Before continuing, you should:
1. If the modem is attached to your computer, make sure it is turned on.
2. Quit any programs that may be using the modem.
Click Next when you are ready to continue.
Don't detect my modem; I will select it from a list.
< Back
Next >
Cancel

5 Select **"(Standard Modem Types)"** from the Manufacturers list, then select **"Standard 56000 bps K56Flex Modem"** from the Models list. Click **Next>** to continue.


Install New Modem
Click the manufacturer and model of your modem. If your modem is not listed, or if you have an installation disk, click Have Disk.
Manufacturers:
Models
(Standard Modem Types)
(VoiceView Modem Types)
3Com
3X
Accton Technology Corpor
Standard 19200 bps Modem
Standard 28800 bps Modem
Standard 33600 bps Modem
Standard 56000 bps K56Flex Modem
Standard 56000 bps V90 Modem
Standard 56000 bps X2 Modem
Have Disk...
< Back
Next >
Cancel

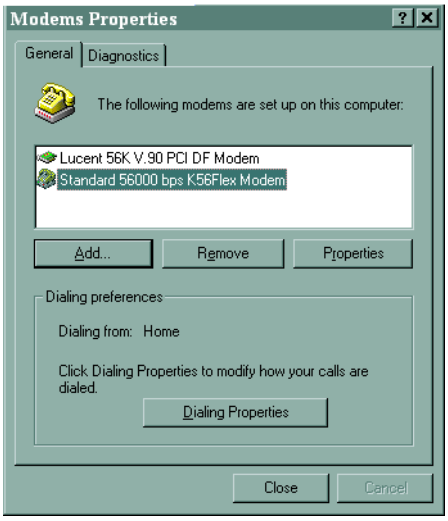
6 Select the port to use with the modem and click **Next>** to continue.


Install New Modem
You have selected the following modem:
Standard 56000 bps V90 Modem
Select the port to use with this modem:
Communications Port (COM1)
Printer Port (LPT1)
< Back
Next >
Cancel

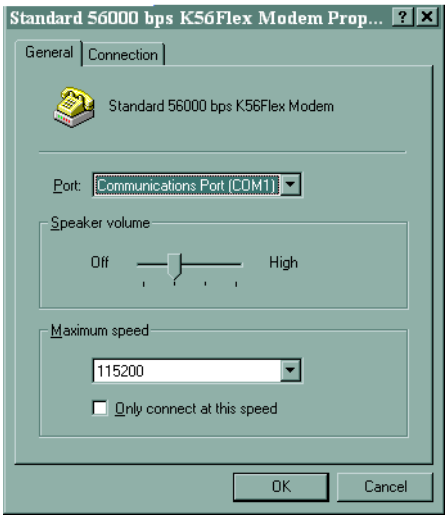
7 Wait while Windows installs the modem. Click **Finish** to complete the installation of the new modem and to return to the **Modems Properties** window.

Install New Modem
Your modem has been set up successfully.
If you want to change these settings, double-click the Modems icon in Control Panel, select this modem, and click Properties.
< Back
Finish
Cancel

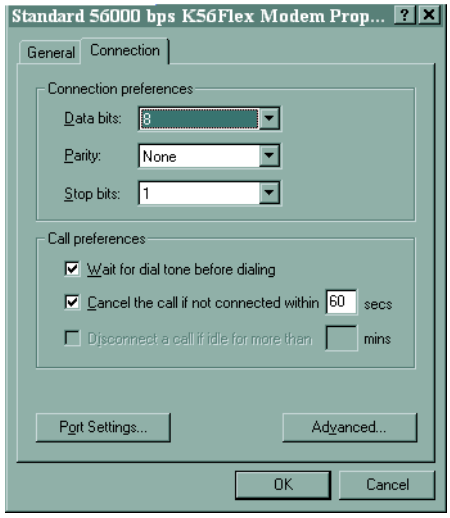
8 You are now ready to configure the new modem. Select **"Standard 56000 bps K56Flex Modem"** and then click **Properties**.



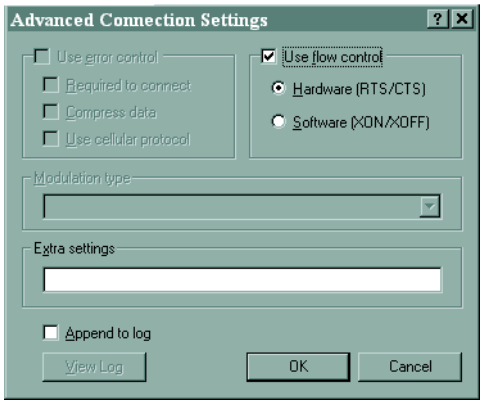
9 On the **General** tab, select the port that is connected to the MDR221A-R2 unit. Select **115200** for the Maximum speed. Do not select **"Only connect at this speed"**, as this will not allow communications from the MDR221A-R2 unit to the MDR220A-R2 unit.



10 Click the **Connection** tab. Select **8** Data bits, **None** for Parity, **1** for Stop bits. Select **"Wait for dial tone before dialing"**. Selecting **"Cancel the call if not connected within xx secs"** is optional.



11 Click **Advanced…** to continue. Select **"Use flow control"** and then select **"Hardware (RTS/CTS)"**. Click **OK** to return to the **Standard 56000 bps K56Flex Modem Properties** window. Click **OK** to return to the **Modems Properties** window. Click **Close** to complete the configuration.



AUTO-ANSWER FEATURE

This feature enables the MDR220A-R2 unit to answer an incoming call over the phone line. In order to enable this feature, the HyperTerminal program must be opened. HyperTerminal is launched by clicking on the Start icon in Windows and selecting Programs. From the Programs list select Accessories, Communications, then HyperTerminal. Once in HyperTerminal, you must type a name for the connection and click OK. Next to the Connect Using field, select the proper COM Port. Make sure the Baud Rate setting is equal to the MDR221A-R2's Baud Rate setting, Data Bits

equals 8, Parity equals None, Stop Bits Equals 1, and Flow Control equals Hardware. Apply the settings and HyperTerminal is ready to send commands.

MDR220A-R2 configuration: Broadcast, Modem Control and RTS should be enabled.

MDR221A-R2 should be configured with default values and Auto Destination enabled.

Make sure Auto-Answer is enabled on the MDR220A-R2: (Refer to RC56D ATCRM.PDF for the AT Commands)

Enable Auto-Answer on the MDR220A-R2

- Connect the MDR221A-R2 to a computer and start HyperTerminal.
- Type the characters ATS0 = n command, where n = the number of rings to Auto-Answer. This command sets the S0 parameter to a value other than zero to enable Auto-Answer. S0 sets the number of rings required before the modem automatically answers a call. Setting this parameter to zero disables auto-answer mode.

Enable DTR On

- Send the AT&D0 command

Save the Auto-Answer configuration to a modem Profile, 0 or 1.

- Send the AT&Wn command, where n = Profile number.

Recall Profile Settings

- Send the AT&Yn to command or ATZn command (where n = Profile number) to recall the Profile settings. ATZn performs a Soft Reset and Restores Profile n. AT&Yn Designates a Default Reset Profile, which will be used after a hard reset.

The modem is now ready to answer a phone call automatically.

Connect to the MDR220A-R2 using a computer or another telecom Host. Once connected, multiple MDR221A-R2 units can communicate with the MDR220A-R2.

CONNECTING TO A NON-PC DEVICE

When using MDR220A-R2 to connect a non-PC device to a phone line, it is important that the MDR221A-R2 unit is configured properly. The MDR221A-R2 unit must match the serial settings of the non-PC host device

To configure the MDR221A-R2 unit, refer to the MDR221A-R2 User's Manual located on the Black Box CD or website.

The MDR220A-R2 unit cannot be reconfigured except by Black Box.

TROUBLESHOOTING

Technical Support is available Monday through Friday 8:30 - 5:00.

Please include the following in all correspondence with Technical Support: company name, phone number, product part number, a good description of the problem or question, and the EEPROM files for both radios.

To save the EEPROM files, read the radio using the Configure page and then press the Save to File button. Attach both files to the email. Visit us online www.Black Box.com.